

What is claimed and desired to be secured by Letters Patent of the United States:

~~1. A method of generating cursor motion on a display from force applied to a user controlled pointing device wherein a velocity of said cursor is related to a pointing component of the applied force according to a dual-gain transfer function.~~

~~2. The method according to claim 1 wherein a first derivative of said dual-gain transfer function is continuous.~~

~~3. A method of generating cursor motion on a display from force applied to a user controlled pointing device comprising the steps of:~~

~~a. applying a first relatively low but non-zero gain to said force applied to said pointing device; and~~

~~b. applying a monotonically increasing fraction of a second relatively higher gain as said force applied to said pointing device increases from zero.~~

~~4. The method according to claim 3 wherein said fraction of said second relatively higher gain increases smoothly.~~

~~5. The method according to claim 3 wherein said second relatively higher gain is applied only when a magnitude of a pointing component of said force is substantially non-decreasing.~~

~~6. A method of indicating selection based on a force applied to a user controlled pointing device in which said selection is indicated when, during a period of relatively increasing vertical component of said force, an accumulation of said vertical component exceeds an accumulation of a magnitude of a simultaneously applied pointing force by a predetermined threshold.~~

7. The method according to claim 6 wherein a selection sensitivity is adjusted to accommodate different operator preferences by adjusting a value of said predetermined threshold.

8. A method of maintaining selection based on a force applied to a user controlled pointing device in which said selection is maintained if a vertical component of said force does not decrease relatively quickly and the magnitudes of both the vertical component and a pointing component of said force do not fall below a minimum threshold.

9. A method of indicating a short duration selection operation based on a force applied to a user controlled pointing device, comprising the steps of:

- a. determining that a rate of increase of a vertical component of the applied force has exceeded a first threshold,
- b. determining that the vertical component of said force has subsequently exceeded a second threshold,
- c. determining that a rate of decrease of the vertical component of said applied force has subsequently exceeded a third threshold,
- d. determining that said rate of decrease occurred within a certain time interval following occurrence of said rate of increase, and
- e. determining that an accumulation over a period subtended by said rates of increase and decrease of the magnitude of the pointing component of said applied force does not exceed a fourth threshold.

10. A method of generating cursor motion on a display from force applied to a user controlled pointing device wherein a velocity of said cursor is negligible when a vertical component of the applied force is relatively decreasing, and is negligible when the vertical component of the applied force is both relatively increasing and exceeding a magnitude of a

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pointing component of the applied force, and is related to the pointing component of the applied force otherwise.

11. A method, comprising the steps of:
retrieving force inputs from an input device;
applying the retrieved force inputs to a dual gain transfer function to produce a motion signal; and
applying the motion signal to control an object.
12. The method according to Claim 11, wherein said input device is a user controlled pointing device and said object is a cursor.
13. The method according to Claim 11, wherein said step of applying the retrieved force inputs comprises applying a pointing component of the retrieved force inputs to said dual gain transfer function to produce said motion signal.
14. The method according to Claim 11, wherein a first derivative of said dual-gain transfer function is continuous.
15. The method according to Claim 11, wherein said dual gain transfer function comprises $M_n = L \cdot F_n + H \cdot S(F_n) \cdot F_n$.
16. A method of generating cursor motion on a display from force applied to a pointing device, comprising the steps of:
generating a force signal from said force applied to said pointing device;
applying a first non-zero gain to said force signal;
applying a fraction of a second gain relatively higher than said first gain to said force applied to said pointing device, said fraction of the second gain monotonically increasing as said force applied to said pointing device increases; and

generating motion of said cursor based on the force signal to which said first and second gain have been applied.

17. The method according to Claim 16, wherein said force applied to said pointing device is a pointing component of force applied to said pointing device.

18. The method according to Claim 16, wherein said second gain is higher than said first gain.

19. The method according to Claim 16 in which said fraction of said second gain increases smoothly .

20. The method according to Claim 16, wherein said second gain is applied only when a magnitude of a pointing component of the force signal is substantially non-decreasing.

21. A method of indicating selection based on a force applied to a user controlled pointing device, comprising the step of:

recognizing a period of relatively increasing selection force on said pointing device in which an accumulation of the selection force exceeds an accumulation of a magnitude of other forces on said pointing device by a predetermined threshold; and

indicating a selection based on the recognized period.

22. The method according to Claim 21, wherein said selection force is a vertical force on said pointing device.

23. The method according to Claim 21, wherein said other forces comprise forces applied in a direction other than a direction of said selection force on said pointing device.

24. The method according to Claim 21, wherein said other forces comprise horizontal forces applied to the pointing device.

25. The method according to Claim 21, further comprising the step of adjusting a selection sensitivity of the pointing device by adjusting the predetermined threshold.

26. A method of maintaining a selection of a pointing device, comprising the steps of: determining selection and pointing components of a force applied to said pointing device; and

maintaining a current selection if the pointing component of said force does not decrease more than a predetermined rate and magnitudes of both the selection and pointing components of said force do not fall below a minimum threshold.

27. The method according to Claim 26, wherein said selection component is a vertical component of said force.

28. The method according to Claim 26, wherein said predetermined rate is approximately $\frac{1}{4}$ of a current value of the selection component of said force.

29. The method according to Claim 26, wherein said minimum threshold comprises .03 of a maximum applied force.

30. A method of indicating a short duration selection operation based on a force applied to a pointing device, comprising the steps of:

(a) determining that a rate of increase of a selection component of said applied force has exceeded a first threshold;

(b) determining that the selection component of said applied force, subsequent to step (a), has exceeded a second threshold;

(c) determining that a rate of decrease of the selection component of said applied force, subsequent to step (b), has exceeded a third threshold;

(d) determining that said rate of decrease occurred within a predetermined time interval following the rate of increase determined in step (a);

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(e) determining that an accumulation over a period subtended by said rates of increase and decrease of the magnitude of the pointing component of said applied force does not exceed a fourth threshold; and

(f) indicating a short duration selection when steps (a), (b), (c), (d), and (e) have been determined.

31. The method according to Claim 30, wherein said short duration selection is a tap.

32. A method of controlling motion of an object from a force applied to a pointing device, comprising the steps of:

(a) applying motion to said object according to a pointing component of the applied force;

(b) reducing an amount of motion applied to said object when a selection component of the applied force is decreasing at a rate faster than a predetermined decrease rate; and

(c) reducing an amount of motion applied to said object when a selection component of the applied force is increasing at a rate greater than a predetermined increase rate and exceeding a magnitude of a pointing component of the applied force.

33. The method according to Claim 32, wherein said object is a cursor.

34. The method according to Claim 32, wherein an amount of reduction of motion applied to said object in steps (b) and (c) comprise setting a velocity of the object to zero.

35. The method according to Claim 32, wherein said selection component is a vertical component of the applied force.

36. The method according to Claim 32, wherein said selection component is force applied in a first direction and said pointing component is force applied in a plane perpendicular to said first direction.

37. A method of controlling movement and selection from a pointing device, comprising the steps of:

retrieving force inputs from the pointing device;

applying a dual gain transfer function having a continuous first derivative to a pointing component of the retrieved force inputs to produce a motion signal; and

applying the motion signal to control motion of a cursor;

wherein:

said step of applying a dual gain transfer function comprises,

applying a first non-zero gain to said force signal, and

applying, if a magnitude of the pointing component is non-decreasing, a fractional part of a second gain higher than said first gain to said force applied to said pointing device, said fractional part of the second gain increasing smoothly and monotonically as said force applied to said pointing device increases from zero.

38. A method of indicating selection based on a force applied to a user controlled pointing device, comprising the steps of:

determining selection and pointing components of a force applied to said pointing device;

recognizing a period of relatively increasing selection force on said pointing device in which an accumulation of the selection force exceeds an integral of a magnitude of pointing forces applied on said pointing device by a predetermined selection threshold; and

determining a selection based on the recognized period;

maintaining a current selection if the pointing component of said force does not decrease more than a predetermined rate and magnitudes of both the selection and pointing components of said force do not fall below a minimum threshold; and

adjusting a selection sensitivity of the pointing device by adjusting the predetermined selection threshold.

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